

Primary stability and stiffness in ankle arthrodesis-crossed screws versus anterior plating

Michael M Betz, Emanuel Benninger, Philipp P Favre, Karl K Wieser, Magdalena M Vich & Norman Espinosa

BACKGROUND

Ankle arthrodesis is commonly used for the treatment of osteoarthritis or failed arthroplasty. Screw fixation is the predominant technique to perform ankle arthrodesis. Due to a considerable frequency of failures research suggests the use of an anatomically shaped anterior double plate system as a reliable method for isolated tibiotalar arthrodesis. The purpose of the present biomechanical study was to compare two groups of ankle fusion constructs - three screw fixation and an anterior double plate system - in terms of primary stability and stiffness.

METHODS

Six matched-pairs human cadaveric lower legs (Thiel fixated) were used in this study. One specimen from each pair was randomly assigned to be stabilized with the anterior double plate system and the other with the three-screw technique. The different arthrodesis methods were tested by dorsiflexing the foot until failure of the system, defined as rotation of the talus relative to the tibia in the sagittal plane. Experiments were performed on a universal materials testing machine. The force required to make arthrodesis fail was documented. For calculation of the stiffness, a linear regression was fitted to the force-displacement curve in the linear portion of the curve and its slope taken as the stiffness.

RESULTS

For the anatomically shaped double-plate system a mean load of 967N was needed (range from 570N to 1400N) to make arthrodesis fail. The three-screw fixation method resisted a mean load of 190N (range from 100N to 280N) ($p=0.005$). In terms of stiffness a mean of 56N/mm (range from 35N/mm to 79N/mm) was achieved for the anatomically shaped double-plate system whereas a mean of 10N/mm (range from 6N/mm to 18N/mm) was achieved for the three-screw fixation method ($p=0.004$).

CONCLUSIONS

Our biomechanical data demonstrates that the anterior double-plate system is significantly superior to the three-screw fixation technique for ankle arthrodesis

in terms of primary stability and stiffness.

type	journal paper/review (English)
date of publishing	21-05-2013
journal title	Foot Ankle Surg (19/3)
ISSN electronic	1460-9584
pages	168-72